

Memorandum

From: Aimee Reynolds

Date: 5/30/2017

Re: Risk-Based Corrective Action (RBCA) Risk-Based Screening Level (RBSL) Changes

Two events have recently occurred that warrant changes to the RBCA RBSLs. In January, the United States Environmental Protection Agency (EPA) released the Integrated Risk Information System (IRIS) Toxicological Review of benzo(a)pyrene (Final Report). This document provides for a new oral cancer slope factor, a new inhalation unit risk, a new reference dose, and a new reference concentration for benzo(a)pyrene. The carcinogenicity of the other carcinogenic polycyclic aromatic hydrocarbons (PAHs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) is relative to that of benzo(a)pyrene.

In May, the Montana Department of Environmental Quality (DEQ) Water Quality Division updated the Montana Circular DEQ-7. As part of the update, the DEQ-7 human health standard for 1,2-dibromoethane went up and the human health standards for acenaphthene, fluoranthene, fluorene, and pyrene went down.

The RBSLs listed in the RBCA Guidance are referenced in rules regarding tank releases (2016 version), landfarm closure (2016 version), and Comprehensive Environmental Cleanup and Responsibility Act (CECRA) listing (2009 version). These previous RBSLs must still be used for the purposes defined by these regulations. The RBCA Guidance document is scheduled for annual review in September 2017 and DEQ will update the Guidance and regulations as appropriate. However, in the interim, DEQ has updated the RBSLs based upon the new toxicity data and the new groundwater standards.

Based on the new cancer slope factor and inhalation unit risk for benzo(a)pyrene, the RBSLs for all the carcinogenic PAHs are now higher than the previous RBSLs. New non-carcinogenicity-based RBSLs for benzo(a)pyrene were also calculated; however, since the carcinogenicity-based RBSLs are lower, these RBSLs are protective of both types of effects. The other PAHs do not exhibit the same non-cancer effects relative to benzo(a)pyrene so non-carcinogenicity-based RBSLs were only calculated for benzo(a)pyrene. The RBSLs for leaching to groundwater required adjustment to be protective of the new standards. These RBSLs may be used for purposes not addressed in the regulations. Attached are tables for each groundwater depth comparing the 2016 Tier 1 RBSLs and 2017 Interim RBSLs based upon either leaching or direct contact, whichever are lower. Also attached is a new Master Table showing the new RBSLs.

References:

Montana Department of Environmental Quality (DEQ). 2017. *Circular DEQ-7*. DEQ, Helena, MT. May.

United States Environmental Protection Agency (EPA). 2017. *Integrated Risk Information System Toxicological Review of Benzo[a]pyrene (Final Report)*. EPA/635/R-17/003Fa. National Center for Environmental Assessment, Office of Research and Development, EPA, Washington, DC. January.

Surface Soil				
Distance to groundwater	< 10 feet to groundwater			
Chemical units (mg/kg)	2016 Residential RBSL (mg/kg)	2017 Residential RBSL (mg/kg)	2016 Commercial RBSL (mg/kg)	2017 Commercial RBSL (mg/kg)
1,2-Dibromoethane (EDB)	0.00002	0.000086	0.00002	0.000086
Acenaphthene	260	27	260	27
Benz(a)anthracene	0.18	1.3	3.2	6.8
Benzo(a)pyrene	0.018	0.13	0.32	2.3
Benzo(b)fluoranthene	0.18	1.3	3.2	23
Benzo(k)fluoranthene	1.8	13	32	230
Chrysene	18	130	320	690
Dibenzo(a,h)anthracene	0.018	0.13	0.32	2.4
Fluoranthene	300	85	550	85
Fluorene	300	35	770	35
Indeno(1,2,3-cd)pyrene	0.18	1.3	3.2	24
Pyrene	220	83	2,800	83

Surface Soil				
Distance to groundwater	10-20 feet to groundwater			
Chemical units (mg/kg)	2016 Residential RBSL (mg/kg)	2017 Residential RBSL (mg/kg)	2016 Commercial RBSL (mg/kg)	2017 Commercial RBSL (mg/kg)
1,2-Dibromoethane (EDB)	0.000051	0.00022	0.000051	0.00022
Acenaphthene	450	91	870	91
Benz(a)anthracene	0.18	1.3	3.2	23
Benzo(a)pyrene	0.018	0.13	0.32	2.4
Benzo(b)fluoranthene	0.18	1.3	3.2	24
Benzo(k)fluoranthene	1.8	13	32	240
Chrysene	18	130	320	2300
Dibenzo(a,h)anthracene	0.018	0.13	0.32	2.4
Fluoranthene	300	280	1,800	280
Fluorene	300	120	2,500	120
Indeno(1,2,3-cd)pyrene	0.18	1.3	3.2	24
Pyrene	220	220	1,900	280

Surface Soil				
Distance to groundwater	> 20 feet to groundwater			
Chemical units (mg/kg)	2016 Residential RBSL (mg/kg)	2017 Residential RBSL (mg/kg)	2016 Commercial RBSL (mg/kg)	2017 Commercial RBSL (mg/kg)
1,2-Dibromoethane (EDB)	0.000079	0.00033	0.000079	0.00033
Acenaphthene	450	140	1,300	140
Benz(a)anthracene	0.18	1.3	3.2	24
Benzo(a)pyrene	0.018	0.13	0.32	2.4
Benzo(b)fluoranthene	0.18	1.3	3.2	24
Benzo(k)fluoranthene	1.8	13	32	240
Chrysene	18	130	320	2400
Dibenzo(a,h)anthracene	0.018	0.13	0.32	2.4
Fluoranthene	300	300	2,500	440
Fluorene	300	180	2,500	180
Indeno(1,2,3-cd)pyrene	0.18	1.3	3.2	24
Pyrene	220	220	1,900	430

Subsurface Soil						
Distance to groundwater	<10 feet to groundwater		10-20 feet to groundwater		> 20 feet to groundwater	
Chemical units (mg/kg)	2016 Construction RBSL (mg/kg)	2017 Construction RBSL (mg/kg)	2016 Construction RBSL (mg/kg)	2017 Construction RBSL (mg/kg)	2016 Construction RBSL (mg/kg)	2017 Construction RBSL (mg/kg)
1,2-Dibromoethane (EDB)	0.00002	0.000086	0.000051	0.00022	0.000079	0.00033
Acenaphthene	260	27	870	91	1,300	140
Benz(a)anthracene	6.8	6.8	23	23	35	35
Benzo(a)pyrene	2.3	2.3	5.4	7.5	5.4	12
Benzo(b)fluoranthene	23	23	54	76	54	120
Benzo(k)fluoranthene	230	230	540	750	540	1200
Chrysene	690	690	2,300	2300	3,500	3500
Dibenzo(a,h)anthracene	5.4	7.5	5.4	24	5.4	38
Fluoranthene	550	85	1,800	280	2,500	440
Fluorene	770	35	2,500	120	2,500	180
Indeno(1,2,3-cd)pyrene	54	77	54	250	54	380
Pyrene	1,900	83	1,900	280	1,900	430

Groundwater		
Chemical units (mg/kg)	2016 RBSL (µg/L)	2017 RBSL (µg/L)
1,2-Dibromoethane (EDB)	0.004	0.017
Acenaphthene	670	70
Fluoranthene	130	20
Fluorene	1,100	50
Pyrene	830	20

MASTER TABLE

ALL POTENTIAL TIER 1 RBSLs FOR SOIL (mg/kg)

Leaching RBSLs are based on the distance from the bottom of the contamination to the groundwater.

Chemical	Leaching 0-10 feet	Leaching 10-20 feet	Leaching >20 feet	Direct Contact Residential	Direct Contact Commercial*	Direct Contact Construction
For Gasoline and Light Hydrocarbons measured using the Montana Method for Volatile Petroleum Hydrocarbons (VPH)						
C5-C8 Aliphatics	220	770	1,200	52	290	410
C9-C12 Aliphatics	11,000	40,000	60,000	77	360	640
C9-C10 Aromatics	130	470	720	130	1,000	1,000
MTBE	0.078	0.16	0.25	52	230	8,900
Benzene	0.07	0.21	0.33	1.3	5.7	240
Toluene	21	65	100	610	5,500	5,500
Ethylbenzene	26	84	130	6.4	28	1,300
Xylenes	320	1,000	1,600	72	310	610
Naphthalene	12	40	62	4.3 ^c	19 ^c	140 ^a
Lead Scavengers						
1,2-Dibromoethane (EDB)	0.000086	0.00022	0.00033	0.04	0.18	7.8
1,2-Dichloroethane (DCA)	0.019	0.052	0.079	0.52	2.3	110
For Diesel and Heavy Hydrocarbons measured using the Montana Method for Extractable Petroleum Hydrocarbons (EPH)						
C9-C18 Aliphatics	53,000	170,000	270,000	110	540	900
C19-C36 Aliphatics	Considered Immobile		24,000	200,000	200,000	200,000
C11-C22 Aromatics	370	1,300	2,000	490	3,900	3,900
Acenaphthene	27	91	140	450	3,800	3,800
Anthracene	2,600	8,800	14,000	2,200	19,000	19,000
Benz(a)anthracene	6.8	23	35	1.3	24	390
Benzo(a)pyrene	2.3	7.5	12	0.13	2.4	39
Benzo(b)fluoranthene	23	76	120	1.3	24	390
Benzo(k)fluoranthene	230	750	1,200	13	240	3,900
Chrysene	690	2,300	3,500	130	2400	39,000
Dibenz(a,h)anthracene	7.5	24	38	0.13	2.4	39
Fluoranthene	85	280	440	300	2,500	2,500
Fluorene	35	120	180	300	2,500	2,500
Indeno(1,2,3-cd)pyrene	77	250	380	1.3	24	390
Naphthalene	12	40	62	4.3 ^c	19 ^c	140 ^a
Pyrene	83	280	430	220	1,900	1,900
1-Methylnaphthalene	2.1	7.1	11	20	81	1,400
2-Methylnaphthalene	6.9	23	35	30	250	250

c = based upon carcinogenicity

n = based upon non-carcinogenicity

* = Construction workers are exposed to both surface and subsurface soil. The lower of construction or commercial RBSLs are provided here.